

XGS PON VfM analysis

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1 Objective



This paper has been developed by Analysys Mason as part of our technical support to the National Broadband Plan (NBP) team at the Department of Communications, Climate Action & Environment (DCCAE) to demonstrate Value for Money (VfM) of the technology selected by NBP Co (i.e. XGS-PON) to implement the NBP network.

2 NBP Requirements

In embarking on the National Broadband Plan, the main objective of the Irish Government is to provide a high-speed broadband service that delivers download speeds of at least 30 Mbit/s and minimum upload speeds of 6 Mbit/s for 100% of the Irish population. A key requirement of the Irish Government is that the network built shall be future proof for the 25-year contract.

3 NBPCo technology choice to meet these requirements

NBPco has a number of a technology options to implement the NBP network including:

- GPON (2.5Gbit/s download and 1.25Gbit/s upload speed, share between 32 (or more) users)
- XGS-PON (10Gbit/s download and 10Gbit/s upload speed, share between 32 (or more) users))
- TWDM-PON (40Gbit/s download and 10/40Gbit/s upload speed, share between users)

GPON is the most mature technology standard and is also the cheapest to deploy. At the end of 2017, we estimated that GPON had been deployed to pass 25% of all premises in Europe.

XGS-PON, which can accommodate 4 times the GPON download bandwidth and 8 times the GPON upload bandwidth, remains more expensive to deploy than GPON¹, but is gathering significant momentum from operators worldwide which will see its cost fall significantly in the next two to three of years due to high anticipated volumes.

TWDM-PON can currently offer 4 times the capacity of XGS-PON but needs to mature as a technology for a wider adoption by operators for the residential mass market. TWDM is currently

¹ Today, XGS-PON technology is approximately 2.5 times more expensive than GPON for a 4 time increase in speed.

an order of magnitude (i.e. 10 times²) more expensive than GPON. Therefore, TWDM-PON is not considered suitable to be implemented for the NBP from the outset³.

In today's market, GPON technology would be sufficient to meet and exceed day 1 specifications required by the NBP⁴ (as GPON can offer in excess of 100Mbit/s in the downlink and 50 Mbit/s in the uplink for all users when they require it). However, since the NBP Contract is a 25-year contract, it is also important to understand future demand profile and industry trends to ensure that the technology initially chosen by NBPco is future proof.

4 Technology strategy of FTTH operators

As mentioned previously, operators who have deployed FTTH have predominantly deployed GPON technology to date. However, a number of operators worldwide have already deployed Next Generation-PON (e.g. XGS-PON and TWDM-PON) technology overlay for different reasons:

- Large incumbent such as China Telecom, China Mobile, KDDI and AT&T⁵ have all deployed XGS-PON overlays.
- Altice, itself a vendor of PON equipment with *Altice Labs*, is committed to deploying XGS-PON overlay in 2019 in denser areas in one of its operations.
- Salt (Switzerland) entered the broadband market in March 2018 using XGS-PON technology and with a 10Gbit/s symmetrical broadband service retailing at less than half of the price of competitors' 1Gbit/s services.
- Verizon, who has longer-term capex and opex avoidance aims, and who places greater emphasis on enterprise and mobile transport opportunities, have deployed the less mature but higher specification TWDM-PON.

In Ireland, open eir and Siro are both deploying GPON-based FTTH networks, and it is anticipated that, due to increasing competition between themselves and with Virgin Media, NG-PON overlay will be deployed within the next 3-4 years in Ireland. Siro have already signalled that it has successfully trialled XGS-PON in December 2017, in partnership with Huawei. Eir, recently acquired by the same owner as Salt may also deploy XGS-PON. Therefore, we expect XGS-PON to be commercially deployed by the mid-2020's.

Other key drivers pushing operators to deploy XGS-PON networks include providing symmetrical multi-gigabit business connectivity, providing backhaul for wireline broadband networks as well as providing backhaul and fronthaul connectivity services for cell densification and 5G.

As demonstrated in the *FTTH technology market adoption and suitability for the NBP* paper referenced above, it seems likely that by mid 2020s, 1Gbit/s services will be sold to residential

² mainly due to WDM lasers and receivers

³ TWDM PON may be deployed in late 2020's or early 2030's as an overlay when higher speeds are required and it becomes a more mature technology.

⁴ 30 Mbit/s speed for the downlink and 6 Mbit/s for the uplink

⁵ Due to launch in Q1 2018

end-users and small businesses, and that in regions with competitive telecoms many, perhaps most, operators will also sell multi-gigabit access. In order to support a substantial number of end-users with 1Gbit/s of download speed when they want it, GPON is not sufficient and upgrades to XGS-PON (or TWDM-PON) would be required instead. This means that, if GPON was to be chosen as the initial technology, it would need to be replaced (including all end-user CPE) by mid 2020s. Instead, XGS-PON would enable NBPco to provide Wholesale Products with similar characteristics to those provided in commercial area until late 2020's or early 2030's, and therefore, significantly delay replacement capex.

5 Impact of choosing XGS-PON over GPON

In this section we try to estimate the cost premium for introducing XGS-PON from day 1 instead of GPON. Our estimation provides a sense of the relative additional capex required to introduce GPON and is not meant to be an exact calculation. However, for establishing whether XGPON represents VFM, we believe this approach to be adequate.

As discussed previously, we expect the cost of OLT and ONT associated with XGS-PON to be 2.5 times the cost associated with the more mature GPON at the outset of the contract.

Also, the standard replacement cycle for mature technology such as GPON is around 7 years (i.e. 7-year refresh cycles). However, for nascent but higher capacity technology such as XGS-PON, the technology lifecycle could be extended to 11-12 years⁶. This is because the higher capacity XGS-PON would satisfy the demand for a longer period of time compared to GPON.

This means that if NBPco choses a mature technology option (i.e. GPON), then it is anticipated that they will have to replace the active equipment 3 times during the Contract Duration. However, if NBPco choses a the less mature but the higher specification XGS-PON at the beginning of the contract period, NBPco will only have to refresh its active equipment once during the Contract Duration, leading to capex avoidance, a reason which has been put forward by Verizon to deploy NG-PON technology⁷.

Therefore, the premium for investing in the higher specification XGS-PON (and in nascent technology as opposed to mature technology) can be simply estimated⁸ considering the relative initial cost and number of replacement cycles of both GPON and XGS-PON:

- Initial XGS-PON cost = 2.5 x Initial GPON cost
- XGS-PON replacement cycles = 1/2 GPON replacement cycles

Therefore :

- Total XGS-PON capex = $2.5 \times 1/2 = 1.25$ x total GPON capex

⁶ Extending replacement cycle requires appropriate maintenance contract with the equipment which NBPCo has already negotiated with Nokia

⁷ although Verizon deployed TWDM-PON rather XGS-PON

⁸ This is assuming that the technology can be replaced at the same cost but with increased capacity in the next refresh cycle

Therefore, we estimate that the cost premium for introducing XGS-PON from day 1 would be 25% (percentage of active equipment costs) over the contract duration.

Based on the FT PCM, the cost of FTTH related active equipment (i.e. OLT and ONT) represents approximately [REDACTED] of the overall capex throughout the Contract Duration. This means that overall, the cost premium for introducing higher capacity XGS-PON day 1 would be:

- *Overall XGS-PON capex premium = Percentage of active equipment capex x XGS-PON active equipment premium*
- *Overall XGS-PON capex premium = [REDACTED]*

Therefore, the overall cost premium for introducing of higher capacity XGS-PON day 1 of the contract would be approximately [REDACTED] if XGS-PON costs were to be maintained as they are. However, as XGS-PON volumes increase, we expect XGS-PON costs to continue falling in the foreseeable future which will further reduce the premium to pay for introducing a more future proof technology at the outset of the 25-year NBP program.

6 Conclusion

Considering the requirements of the NBP contract, the future demand, other operators' strategy, and the relatively low-cost premium linked with the introduction the higher capacity XGS-PON at the outset of the contract (instead of GPON), we believe that XGS-PON can be considered as a Value for Money technology in the context of the NBP.